

The role of diet in cardiovascular disease in black South Africans: both sides of the story

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Dit begin alles hier

ABSTRACT

Background

Cardiovascular disease (CVD) is becoming one of the leading causes of death in middle and low income countries, with ischaemic heart disease specifically being predicted to be the 4th and 5th causes respectively. The numerous risk factors for the development of CVD have been extensively researched; however, the same wealth of data is not available for the black South African population as there is for Caucasians. Although the same risk factors that are present in Caucasians have been seen to be present in the black South Africans, there are questions regarding the contributory roles of the individual risk factors, particularly within the context of urbanisation. The role of diet in CVD has been widely studied and it is known that with urbanisation there are dietary changes which are thought to add the development of CVD. With urbanisation, however, there are numerous other lifestyle changes taking place within a population, making it difficult to isolate and make conclusions of the individual role of diet. Added to this is the complex issue of assessing dietary intake. Assessing only nutrient or food intake does not give a holistic picture of dietary habits. The main aim of this study was to determine the association between dietary intake and CVD risk in black South Africans in the context of urbanisation.

Methods

The first study that forms part of this thesis was a case-control study aimed at exploring the risk factor profile and clinical presentation of black South African patients with coronary artery disease (CAD). In this study clinical, biochemical and nutrient intakes were compared with a black South African control group that were matched for age and body composition. The second study to form part of this thesis aimed to relate the dietary intakes of the Prospective Urban and Rural Epidemiological (PURE) study population to CVD risk associated with urbanisation, by using both nutrient intake and predefined diet quality scores (DQS). The Healthy Diet Indicator (HDI) and the Deficiency and Excess Score were carefully selected from the large number of available scores and adapted as best as possible for the black South African population.

The third study aimed to investigate the role of dietary intake by using nutrients as well as food group consumption patterns as a risk factor in urbanised black South African CAD patients. The dietary habits of the coronary artery disease (CAD) patients were compared to that of an apparently healthy reference group of volunteers selected from the PURE study population. This urbanised reference group was from a similar socio- demographic

background and was selected according to their risk for CVD. The Reynolds Risk score which includes C-reactive protein as factor was used to stratify the PURE population into CVD risk categories, in order to select the reference group, which had a low risk (<5%) of developing CVD within the next 10 years. Dietary intake was assessed by comparing nutrient and food group intake (including the ultra-processed food group category).

Results and discussion

Black South African CAD patients had increased levels of the same risk factors that are seen in Caucasians with insulin resistance and LDL size being particularly significant in their contribution. Apart from a lower vitamin C intake, no differences in dietary intake and physical activity were observed between the CAD and control group. When comparing the dietary intake of the rural and urban group, the urban group, who had an increased CVD risk, had higher intakes of macro- and micronutrients as well as higher DQS. The DQS must however be interpreted with caution, as when looking at the absolute intakes of individual components of the scores, the urban group was still deficient in a numerous vital micronutrients. A similar picture was seen in the third study, in that the CAD patients also consumed more saturated fatty acids and ultra-processed foods than the reference group, as well as more of the “protective” foods such as fruit and vegetables. However, although their dietary habits could be considered prudent, they were still inadequate in numerous important micronutrients.

Conclusion and recommendation

This thesis therefore shows that there are two sides of the story regarding the role of diet in CVD in black South Africans. Although it is important to follow prudent dietary guidelines so as to control the intake of nutrients and foods known to play a role in the development of CVD, it is just as important to ensure adequate intake of the foods rich in micronutrients known to protect against CVD. Dietary advice and prevention programs should also focus on the adequacy aspect of the diet, such as increasing fruit and vegetable and low fat dairy intake, not only on the prudent diet aspect. Additionally, nutrient intake alone does not adequately explain the link between diet and CVD and additional analyses such food consumption patterns are required.

KEY WORDS: Coronary artery disease, cardiovascular disease risk, diet quality

UITTREKSEL

Agtergrond

Kardiovaskulêre siekte (KVS) is besig om een van die hooforsake van dood in middel- en lae-inkomste lande te word, en iskemiese hartsiekte word spesifiek voorspel om die 4^{de} en 5^{de} oorsake respektiewelik te wees. Die talle risikofaktore vir die ontwikkeling van KVS is reeds uitvoerig ondersoek. Daar is egter nie dieselfde skat van data beskikbaar vir die swart Suid-Afrikaanse populasie as wat daar vir Kaukasiërs is nie. Hoewel dieselfde risikofaktore wat in Kaukasiërs teenwoordig is in die swart Suid-Afrikaners gesien is, is daar vrae wat betref die bydraende rolle van die individuele risikofaktore, veral in die konteks van verstedeliking. Die rol van dieet in KVS is wereldwyd omvattend bestudeer en dit is bekend dat met verstedeliking daar dieetveranderinge is wat vermoedelik tot die ontwikkeling van KVS bydra. Met verstedeliking vind daar egter talle ander leefstylveranderinge in 'n populasie plaas, wat dit moeilik maak om die individuele rol van dieet te isoleer en gevolgtrekkings te maak. Boonop is daar die komplekse kwessie van bepaling van dieetinname. Bepaling van slegs voedingstof- of voedselinname gee nie 'n holistiese beeld van dieetgewoontes nie. Die hoof doel van hierdie projek was om die assosiasie tussen dieetinname en risiko vir KVS in swart Suid Afrikaners te bepaal in die konteks van verstedeliking.

Metode

Die eerste studie wat deel vorm van hierdie proefskrif was 'n gevalle-kontrole studie gemik op die verkenning van die risikofaktorprofiel en kliniese uitbeelding van swart Suid-Afrikaners met koronêre arteriële siekte (CAD). In hierdie studie is kliniese, biochemiese en voedingstofinnames vergelyk met 'n kontrolegroep wat vir ouderdom en liggaamsamestelling gepaar was. Die tweede studie wat deel vorm van hierdie proefskrif se doel was om die dieetinname van die *Prospective Urban and Rural Epidemiological* (PURE)-studiepopulasie in verband te bring met KVS-risiko met verstedeliking, deur ook vooraf gedefinieerde kwaliteitstellings van voedingstofinname te gebruik. Die *Healthy Diet Indicator* (HDI) en die *Deficiency* en *Excess Score* is versigtig uit die groot aantal beskikbare maatstawwe gekies en so goed as moontlik vir die Suid-Afrikaanse swart populasie aangepas.

Die derde studie het ten doel gehad om die rol van dieetinname as risikofaktor te ondersoek deur gebruik te maak van voedingstof- en voedselgroepinnamepatrone in verstedelike Suid-Afrikaanse swart CAD-pasiënte. Die eetgewoontes van die CAD-pasiënte is vergelyk met die van 'n verwysingsgroep van oënskynlik gesonde vrywilligers gekies uit die PURE-studiepopulasie. Hierdie verstedelike verwysingsgroep was van 'n soortgelyke sosio-

demografiese agtergrond en was gekies volgens hulle KVS-risiko. Die *Reynolds*- risikotelling wat C-reaktiewe proteïen as faktor insluit was gebruik om die PURE-populasie te stratifiseer in KVS-risiko kategorieë, ten einde die verwysingsgroep te kies wat 'n lae risiko (<5%) het om KVS binne die volgende 10 jaar te ontwikkel. Dieetinname was bepaal deur vergelyking van voedingstof- en voedselgroepinname (insluitende ultra-geprosesseerde voedselgroepkategorieë).

Resultate en bespreking

Suid-Afrikaanse swart CAD-pasiënte het verhoogde vlakke van dieselfde risikofaktore gehad as wat in Kaukasiërs teenwoordig is. Insulienweerstand en LDL-grootte is besondere betekenisvolle bydraers hiertoe. Behalwe vir 'n laer vitamien C-inname, is geen verskille in dieetinname en fisiese aktiwiteit tussen die CAD-groep en kontrolegroep waargeneem nie. Met vergelyking van die dieetinname van die plattelandse en stedelike groepe, blyk dit dat die stedelike groep, wat 'n verhoogde CAD-risiko het, hoër innames van makro- en mikrovoedingstowwe asook hoër dieetkwaliteittellings gehad het. Die dieetkwaliteittelling moet egter versigtig geïnterpreteer word, want in terme van die absolute innames van die individuele komponente van die telling was die stedelike groep steeds gebrekkig in talle belangrike mikrovoedingstowwe. 'n Soortgelyke beeld is in die derde studie waargeneem, daarin dat die CAD-pasiënte ook meer versadigde vetsure en ultra-geprosesseerde voedsels as die verwysingsgroep ingeneem het, asook meer van die “beskermdes” voedsels soos vrugte en groente. Hoewel hulle eetgewoontes egter as omsigtig beskou kan word, was dit steeds ontoereikend in talle belangrike mikrovoedingstowwe.

Gevolgtrekking en aanbeveling

Hierdie proefskrif toon dus dat daar twee kante van die saak betreffende die rol van dieet in KVS in swart Suid-Afrikaners is. Hoewel dit belangrik is om omsigtige dieetriglyne te volg om beheer uit te oefen oor die inname van voedingstowwe en voedsels wat 'n rol speel in die ontwikkeling van KVS, is dit net so belangrik om te verseker dat voedsels ingeneem word wat ryk is in mikronutriënte en wat daarvoor bekend is dat dit beskerm teen die ontwikkeling van KVS. Dieetadvies en voorkomingsprogramme moet ook fokus op die toereikende aspek van die diet, soos verhoogde inname van vrugte en groente en lae-vet suiwel, nie net op die omsigtigheidsaspek nie. Verder verduidelik voedingstowweinname alleen nie voldoende die verband tussen dieet en KVS nie en addisionele analyses soos voedselverbruikpatrone is nodig.

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LIST OF ABBREVIATIONS

AA	Arachidonic acid
ACE	Angiotensin – converting enzyme
ADA	American Dietetic Association
AHA	American Heart Association
AI	Adequate intake
ALA	α Linolenic acid
AMI	Acute myocardial infarction
Apo A-1	Apolipoprotein A-1
ApoB	Apolipoprotein B
ART	Anti – retroviral therapy
ASH	American Society of Hypertension
ASSIGN	ASSessing cardiovascular risk, using SIGN guidelines
ATP	Adenosine triphosphate
AUROC	Area under the receiver operating characteristic curve
BMI	Body mass index
BP	Blood pressure
CAD	Coronary artery disease
CCA	Common carotid artery
CDC	Centres for Disease Control
CHD	Coronary heart disease
CRA	Comparative risk assessment
CRP	C – reactive protein
CT	Computer tomography
CVD	Cardiovascular disease
DALYs	Disability adjusted life years

DASH	Dietary Approaches to Stop Hypertension
DBP	Diastolic blood pressure
DCCT	Diabetes Control and Complications Trial
DHA	Docosahexaenoic acid
DM	Diabetes Mellitus
DRI	Dietary reference intake
DQS	Diet quality score
EAR	Estimated average requirement
EPA	Eicosapentaenoic acid
ET	Endothelium
FBDGs	Food based dietary guidelines
FFA	Free fatty acids
FMD	Flow – mediated dilatation
GI	Glycaemic index
GL	Glycaemic load
HC	Hip circumference
HDI	Healthy Diet Indicator
HDL-C	High density lipoprotein cholesterol
HbA _{1c}	Haemoglobin A _{1c}
HIV/AIDS	Human immunodeficiency virus/Acquired immune deficiency syndrome
Hs-CRP	High sensitivity CRP
IDL	Intermediate density lipoprotein
IGF-1	Insulin – like growth factor - 1

IGFBP-3	Insulin binding protein 3
IHD	Ischaemic heart disease
IL-6	Interleukin – 6
IMT	Intima – media thickness
IR	Insulin resistance
IRS	Insulin resistance syndrome
ISH	International Society of Hypertension
JNC	Joint National Committee
JUPITER	Justification for the Use of statins in Prevention: an Intervention Trial evaluating Rosuvastatin
K ⁺	Potassium
KIHD	Kuopia Ischaemic Heart Disease
KVS	Kardiovaskulêre siekte
LA	Linoleic acid
LASSA	Lipid and Atherosclerosis Society of Southern Africa
LDL-C	Low density lipoprotein-cholesterol
Lp(a)	Lipoprotein (a)
MDSa	Alternate Mediterranean Diet Score
MI	Myocardial infarction
MRC	Medical Research Council
MRI	Magnetic resonance imaging
MTHFR	Methylene tetrahydrofolate reductase
MUFAs	Monounsaturated fatty acids
Na ⁺	Sodium
NCEP	National Cholesterol Education Program

NICE	National Institute for Health and Clinical Excellence
NO	Nitric oxide
NGSP	National Glycohemoglobin Standardisation Program
OGTT	Oral glucose tolerance test
PAI-1	Plasminogen activator – inhibitor – 1
PP	Pulse pressure
PROCAM	PROspective CARdiovascular Münster study
PUFA	Polyunsaturated fatty acids
PURE	Prospective Urban and Rural Epidemiological study
RAAS	Renin-angiotensin aldosterone system
RCTs	Randomised control trials
REGARDS	REasons for Geographical and Racial Differences in Stroke
SADHS	South African Demographic and Health Survey
SAHS	South African Hypertensive Society
SAMA	South African Medical Association
SBP	Systolic blood pressure
SCORE	Systematic COronary Risk Evaluation
SHS	Second hand smoke
SFA	Saturated fatty acids
SIGN	
SIMD	Scottish Index of Multiple Deprivation
SMCs	Smooth muscle cells
T2DM	Type 2 Diabetes Mellitus
TC	Total cholesterol
TG	Triglyceride

THUSA	Transition in Health during Urbanization in South Africa
TNF α	Tumour necrosis factor α
t-PA	Tissue – type plasminogen activator
t-PA _{ag}	Tissue – type plasminogen activator (Antigen)
TFA	Trans fatty acids
u-PA	Urokinase – type plasminogen activator
VCAM-1	Vascular cell adhesion molecule-1
VLDL-C	Very low density lipoprotein- cholesterol
WC	Waist circumference
WHtR	Waist – to – height ratio
WHO	World Health Organisation
WHR	Waist – hip ratio